Electrochemistry In-Class Assignment

1. ovide the oxidation number of the underlined element. [KU – 6 marks]
   (a) $\underline{S}O_2$
   (b) $Mg\underline{I}_2$
   (c) $Na\underline{N}O_3$
   (d) $\underline{Cr}O_4^{2-}$
   (e) $\underline{C}O_3^{2-}$
   (f) $\underline{P}_4O_{10}$

2. Balance the following equation using the ion-electron method. Show your work. [MC – 5 marks]

   $Ag_2O(s) + CH_2O(aq) \rightarrow Ag(s) + CHO_2^-(aq)$ basic solution

3. Balance the following equation using the oxidation method. Show your work. [MC – 5 marks]

   $HCl(aq) + H_2SO_4(aq) \rightarrow SO_2(g) + Cl_2(g)$ acidic solution

4. In an experiment, the following cell is set up, $Zn(s)|Zn^{2+}(aq)||Ag^+(aq)|Ag(s)$.
   (a) Draw a diagram of this cell. Include the beakers, salt bridge (with sodium nitrate), specific electrodes, specific electrolytes, external circuit and voltmeter. [I – 4 marks]
   (b) Indicate the direction of electron flow on the diagram. [I – 1 mark]
   (c) Indicate direction of ion flow, from the salt bridge, on the diagram. [2 marks]
   (d) Label anode and cathode under the appropriate compartment. [I – 2 marks]
   (e) Write out the ½-cell reactions occurring in each compartment under the appropriate compartment. Include the ½-cell potentials. [I – 4 marks]
   (f) Write out the overall cell reaction and calculate the E_{cell}. [I – 2 marks]
   (g) Circle and label the oxidizing and reducing agents. [I – 2 marks]

5. Predict anode, cathode and net cell reactions for each electrolytic cell. Calculate the minimum voltage that must be applied. [I – 8 marks]
   (a) $C(s)|Cr^{3+}(aq), Br^-(aq)|C(s)$
   (b) $Pt(s)|K^+(aq), OH^-(aq)|Pt(s)$

MC	/10 marks		
KU	/6 marks	TOTAL	/41 marks
I	/25 marks		

16.

33/40

1a) $x-4=0$, $x=+4$ ✓ b) $2-2x=0$, $x=+1$ ✗ c) $1+x-6=0$, $x=6-1$, $x=+5$ ✓ d) $x-8=-2$, $x=+6$ ✓

5 KU e) $x-6=+2$, $x=-2+6$, $x=+4$ ✓ f) $4x-20=0$, $4x=20$, $x=+5$ ✓

2) $Ag_2O(s) + CH_2O(aq) \rightarrow Ag(s) + CHO_2^-(aq)$

$Ag_2O(s) \rightarrow 2Ag(s)$

$Ag_2O(s) \rightarrow 2Ag(s) + H_2O$

$2e^- + 2H^+ + Ag_2O(s) \rightarrow 2Ag(s) + H_2O$

$2OH^- + 2H^+ + Ag_2O(s) + H_2O + CH_2O(aq) \rightarrow CHO_2^-(aq) + 3H^+ + 2e^- + 3OH^- + 2Ag(s) + H_2O$

$OH^- + Ag_2O(s) + CH_2O(aq) \rightarrow H_2O + CHO_2^-(aq) + 2Ag(s)$

$CH_2O(aq) \rightarrow CHO_2^-(aq)$

$H_2O + CH_2O(aq) \rightarrow CHO_2^-(aq)$

$H_2O + CH_2O(aq) \rightarrow CHO_2^-(aq) + 3H^+ + 2e^- + 3OH^-$

3) $\overset{+1}{H}\overset{-1}{Cl}(aq) + \overset{+1}{H_2}\overset{+6}{S}\overset{-2}{O_4}(aq) \rightarrow \overset{+4}{S}\overset{-2}{O_2}(g) + \overset{0}{Cl_2}(g)$ (+6 gain e^-, red. (2))

5 loses e^-, Oxi. (2)

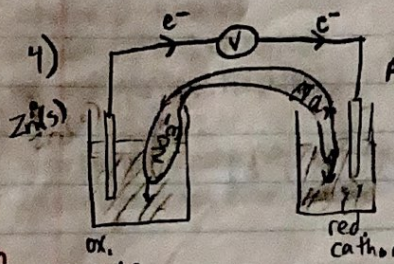
$x-8+2=0$, $x=-2+8$, $x=+6$

$x-4=0$, $x=4$

$2HCl(aq) + H_2SO_4(aq) \rightarrow SO_2(g) + Cl_2(g) + 2H_2O(l)$

16

4)



$Zn^{2+}(aq) + 2e^- \leftarrow Zn(s)$ $E_{ox.} = +0.76V$

$Ag^+(aq) + e^- \rightarrow Ag(s)$ $E_{red} = 0.8V$

$0.76V + 0.8V = \boxed{1.56V}$

ox. agent = Ag, red. agent = Zn

Overall = $Zn(s) + 2Ag^+(aq) \rightarrow 2Ag(s) + Zn^{2+}(aq)$

5) a) $Cr^{3+}(aq) + 3e^- \leftarrow Cr(s)$ $E_{ox.} = 0.73$ anode, ox. $\times 2$

$Br_2(l) + 2e^- \rightarrow 2Br^-(aq)$ $E_{red.} = 1.09$ cathode, red. $\times 3$

$2Cr^{3+}(aq) + 6e^- \leftarrow 2Cr(s)$ $E_{ox.} = 0.73V$

$3Br_2(l) + 6e^- \rightarrow 6Br^-(aq)$ $E_{red.} = 1.09V$

2

$2Cr(s) + 3Br_2(l) \rightarrow 6Br^-(aq) + 2Cr^{3+}(aq)$ $\varepsilon^\circ = \boxed{1.82V}$ max voltage?

$2H_2O(l) + 2e^- \rightarrow H_2(g) + 2OH^-(aq)$

5b) $K^+(aq) + e^- \rightarrow K(s)$ ×4 cathode, red.

$O_2(g) + 2H_2O(l) + 4e^- \leftarrow 4OH^-$ ×1 anode, ox.

$4OH^- \rightarrow O_2(g) + 2H_2O(l) + 4e^-$ ε ox. = 0.40 V

$4K^+(aq) + 4e^- \rightarrow 4K(s)$ ε red. = -2.92 V

$4OH^- + 4K^+(aq) \rightarrow O_2(g) + 2H_2O(l) + 4K(s)$ ε° = -2.52 V

min voltage?

Lower Melting Point

a) Li or Al → don't remember

b) Kr or Ne

c) LiF or RbI

Last question

What are the 2 Tests?

electrical conductivity

& hardness

or heat conductivity